

Team Under the Microscope

Rotating Magnetic Field Device

Problem Statement

- ★ Blood clot associated diseases are a leading cause of death and disability worldwide
- ★ Thrombosis is a serious disease that causes blood clots inside a vessel
- ★ About 60,000 – 100,000 people in the United States die of Thrombosis
- ★ Current treatments require surgery or potentially harmful techniques



SAN DIEGO STATE UNIVERSITY

Team Members



Bashar Ablah
Project Manager



Raid Yousof
Manufacturing Engineer



Blake Haslam
Design Engineer



Jeffrey Johnson
Testing Engineer

Sponsor

Dr. Wenwu Xu
Professor of ME Department
San Diego State University

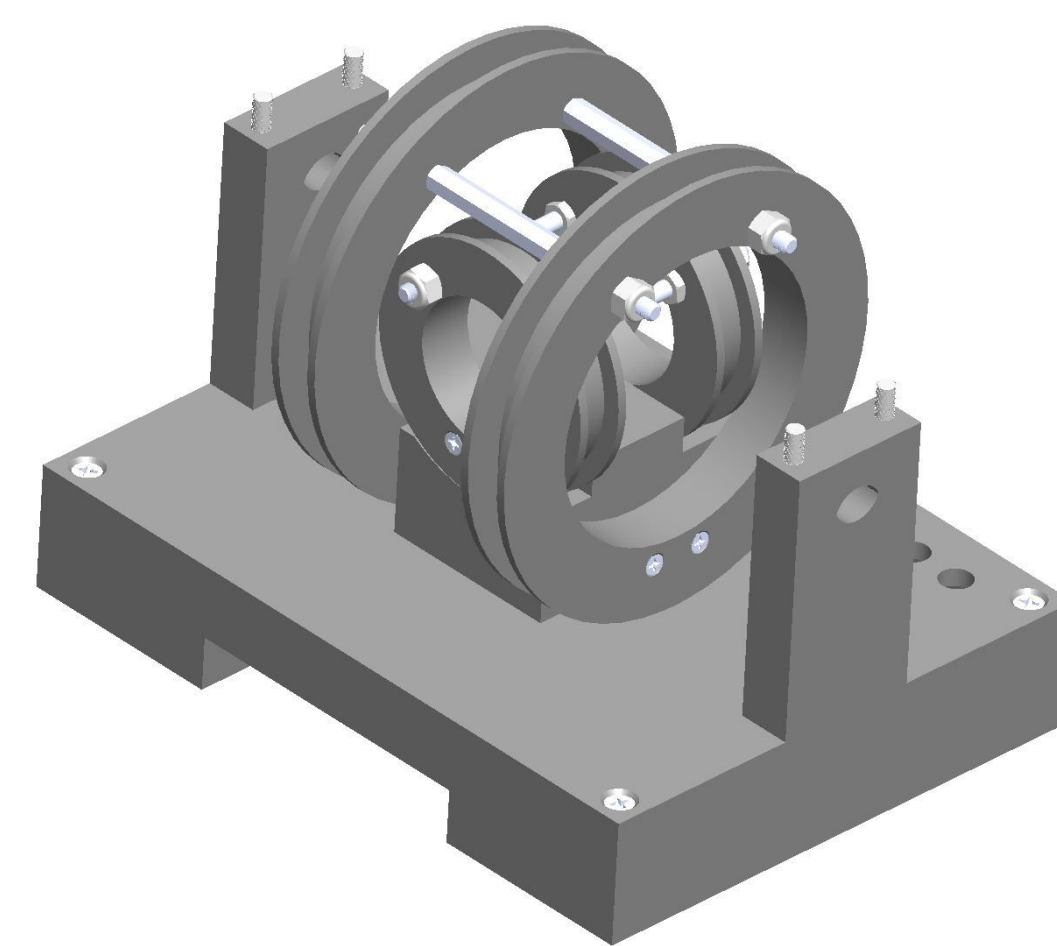
Project Purpose

- ★ To test non-invasive solutions for the removal of blood clots
- ★ To design, analyze, and build a rotating magnetic field device, that fits under a microscope, to view the interaction between magnetic nanoparticles and a synthetic blood clot specimen

Project Goal

The elongated magnetic nanoparticles will be driven to rotate due to the force of the rotating magnetic field created in the homogeneous region of the Helmholtz coils, thus scraping against the synthetic blood clot specimen, and ultimately breaking the blood clot down.

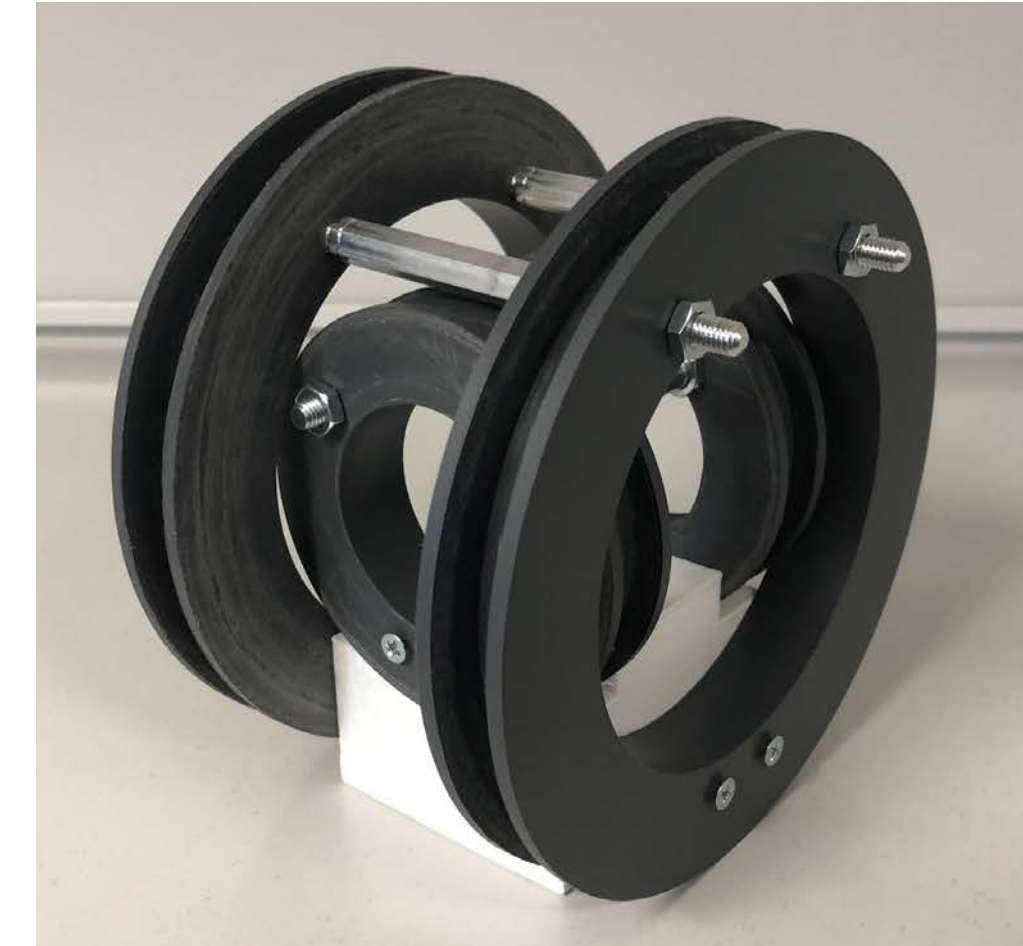
CAD Model



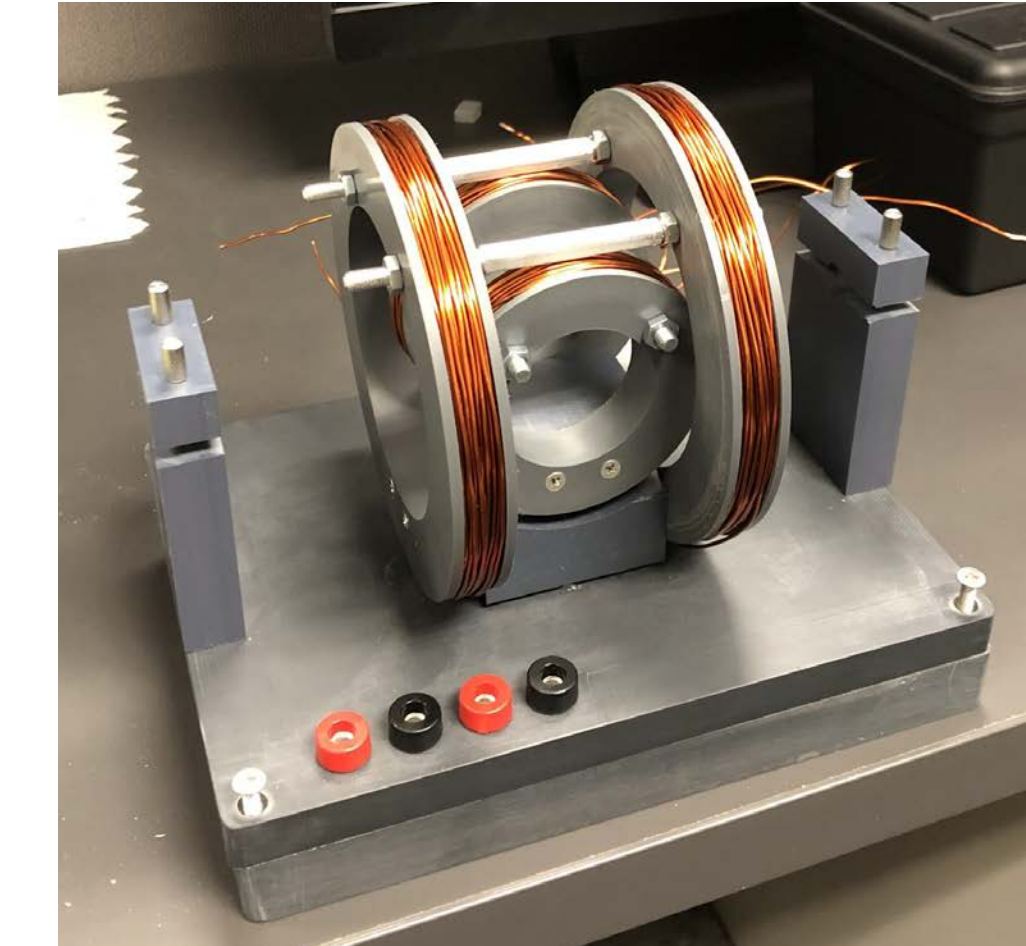
Prototype 1



Prototype 2



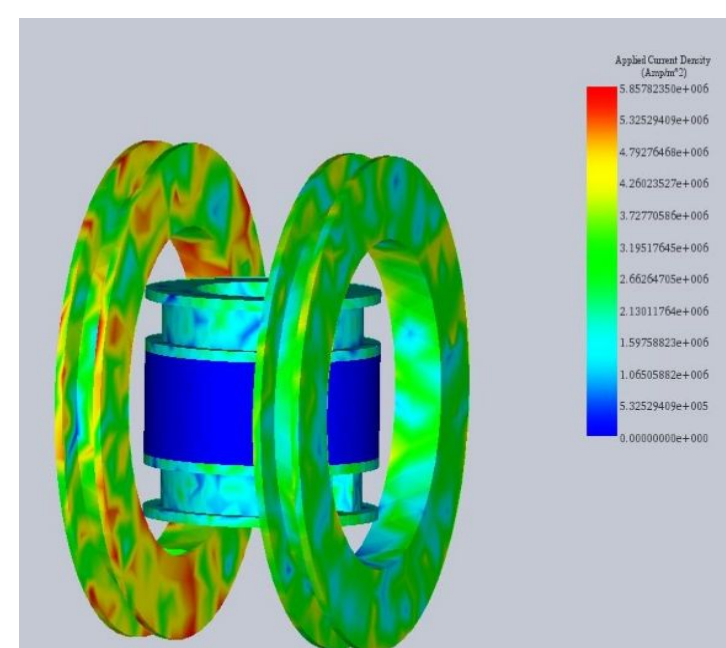
Final Product



Acknowledgment

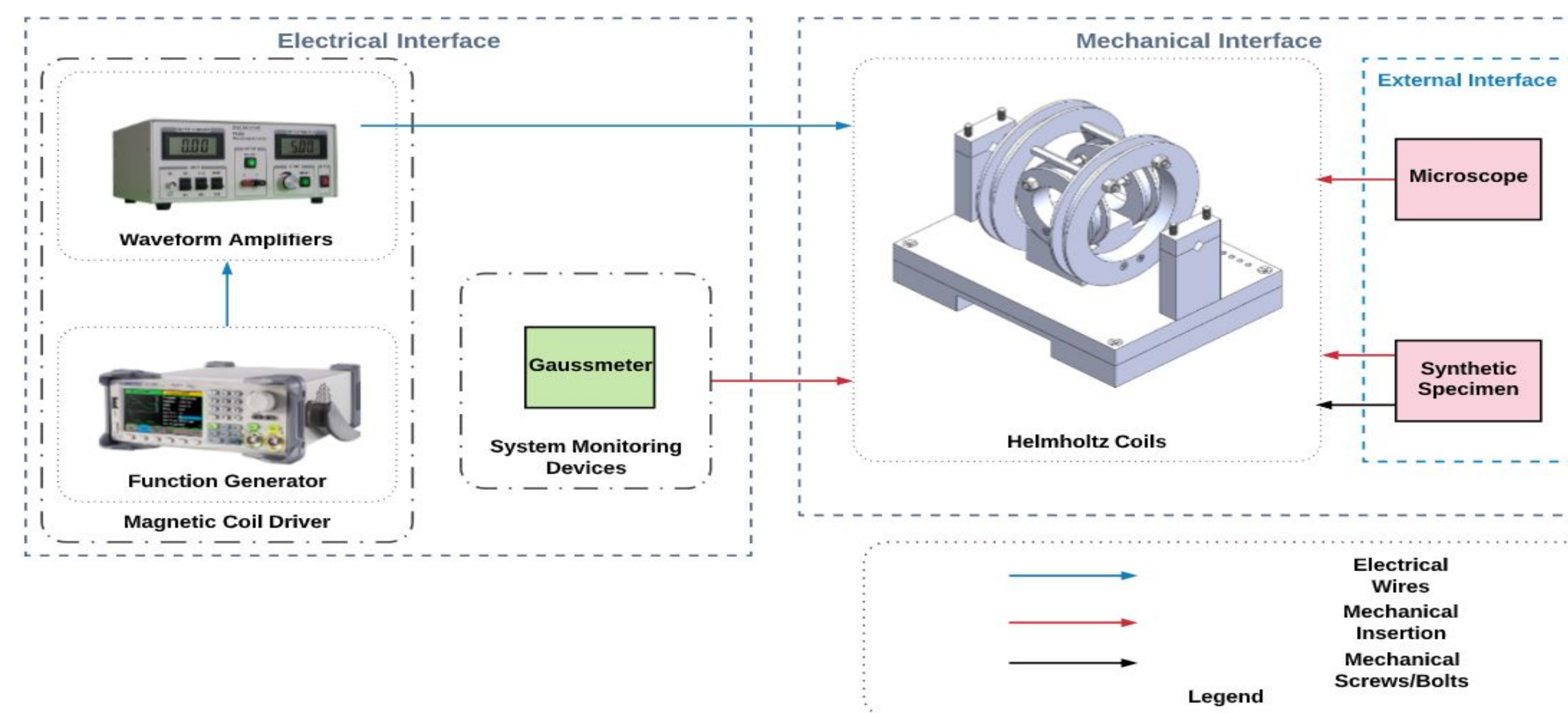
Our Team would like to thank both the SDSU engineering department and Build IT Lab for allowing us to utilize their machines, equipment, and tools for the fabrication process. The Prototrak Mill, Lathe, and 3D printer helped us to accomplish the final product successfully.

Heat Analysis

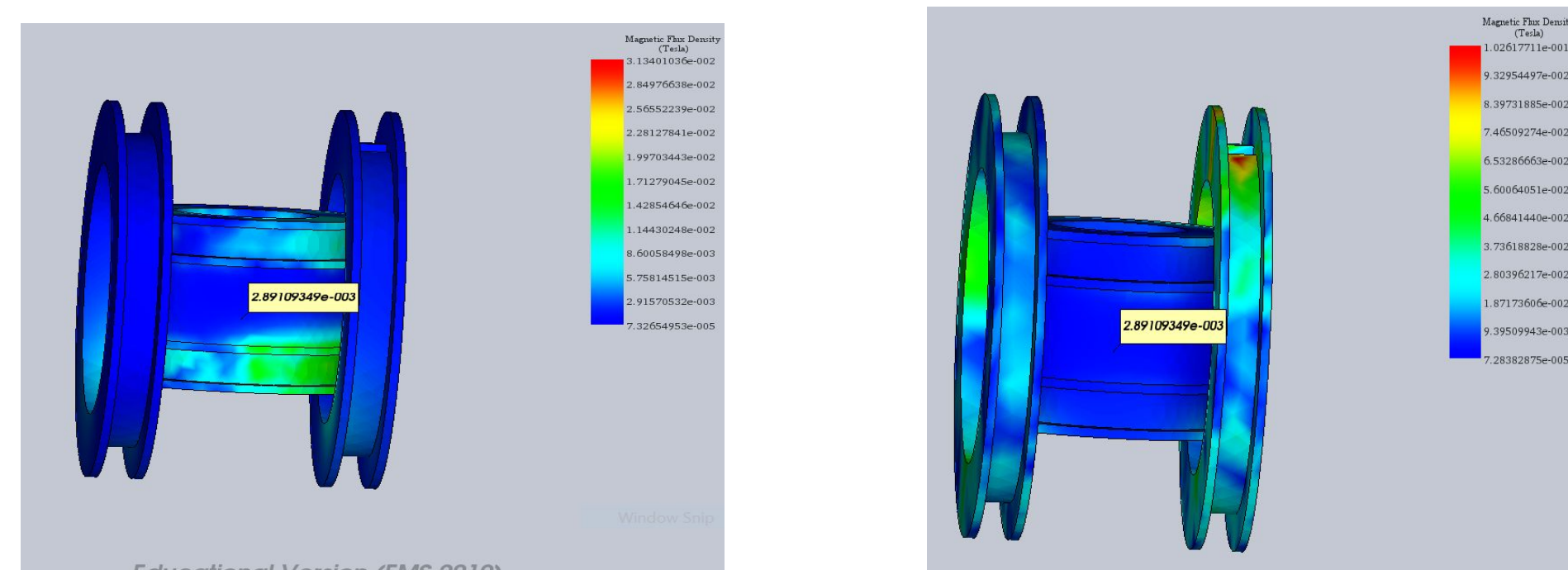


Heat Analysis for Helmholtz Coils						
Coil Size	Length L_{wire} (Cm)	Volume V_{wire} (Cm ³)	mass m_{wire} (g)	Power P_{max} (J/s)	Heat Q_{Tmin} (J)	Tempereture ΔT_{Tmin} (°C)
Large	2199.11	714.36	6400.68	0.02	90.09	0.04
Small	942.48	242.79	2175.42	0.89	94.15	0.11

System Level Diagram



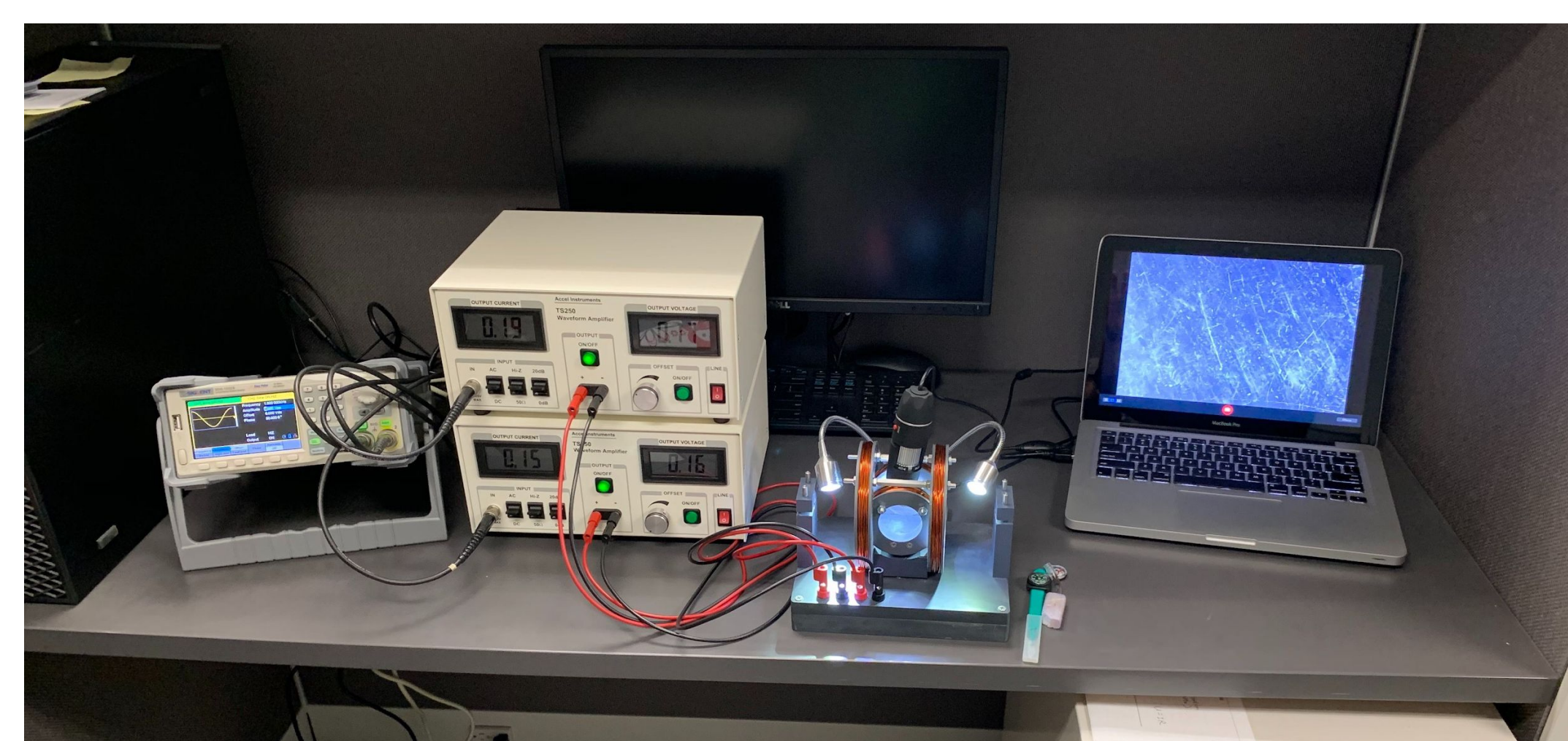
Magnetic Flux Analysis



Magnetic Field Analysis for Helmholtz Coils @1000Hz					
Coil Size	no. of Turns n (turns)	Voltage $V_{required}$ (volt)	AWG Size	Constants	
Large	70	71.88	18	$B_{Required}$ (mT)= 5	
Small	50	17.29	20	I_{large} (Amp)= 4	I_{small} (Amp)= 3.34

Magnetic Field Analysis for Helmholtz Coils @5000Hz					
Coil Size	no. of Turns n (turns)	Voltage V_{output} (volt)	AWG Size	Constants	
Large	70	70.98	18	$B_{Required}$ (mT)= 1	
Small	50	17.34	20	I_{large} (Amp)= 0.79	I_{small} (Amp)= 0.67

Device Set-up (Function Generator, Amplifiers, Helmholtz Coils, Microscope)



Exploded View

